. . . THE . . .

MONTHLY REVIEW

Published by the

American Electro-Platers Society

KRESGE-HOOKER
WAYNE
UNIVERSITY
SCIENTIFIC LIBRARY

A SOCIETY FOR THE ADVANCEMENT
OF THE
SCIENCE OF ELECTRO-PLATING

v.7 #5

MAY, 1920

Entered as second-class matter, March 1, 1917, at the Post Office at St. Louis, Mo., under the Act of August 24, 1912

Acceptance for mailing at special rate of postage provided for in section 1103, Act of October 3, 1917, authorized August 12, 1918

Copyright, by American Electro-platers' Society

This book is the property of the members of the American Electro-Platers' Society. Papers printed herein are released after 10 days, except when rights are reserved.

EXECUTIVE BOARD, A. E. S., 1919-1920.

PRESIDENT.

Oscar E. Servis, 5305 Warner Avenue, Chicago, Illinois.

FIRST VICE-PRESIDENT.

Sylvester P. Gartland, 128 Bryan St., Rochester, N. Y.

SECOND VICE-PRESIDENT.

Philip W. Uhl, 2432 N. 29th St., Philadelphia, Pa.

SECRETARY-TREASURER.

J. E. Sterling, 473 Tenth Ave., Long Island City, N. Y.

PAST PRESIDENT.

Walter Fraine, 507 Grand Avenue, Dayton, Ohio.

EDITOR.

H. H. Williams, 4156 Botanical Avenue, St. Louis, Mo.

ASSOCIATE EDITORS.

Dr. W. Blum, Bureau of Standards, Washington, D. C.
F. Mesle, Sherrill, N. Y.

INDEX

Convention of 1920 3
Principles of Electro-Plating II 4
Galvanizing of Aluminum 13
Electro Deposition of Copper Upon Wax II.
Continued from April 14
Correction 15
What the Branches Are Doing 16
News Notes 24

Finish every day and be done with it; you have done what you could. Some blunders and absurdities no doubt crept in; forget them as soon as you can. Tomorrow is a new day; begin it well and serenely, and with too high a spirit to be cumbered with your old nonsense. Today all is good and fair. It is too dear with its hopes and invitations to waste a moment on the yesterdays.—Emerson.

MONTHLY REVIEW

Published by the

American Electro-Platers' Society

Editors' Office, 4156 Botanical Ave., St. Louis, Mo.

Vol. 7 MAY No. 5

CONVENTION OF 1920

The Annual Convention of our Society will be held at Rochester, N. Y., on June 30, July 1, 2, 3, at which time each branch should be represented by delegates and as many others as possible. The success of the Convention depends much upon the attendance, and every member may feel that he has a part in it. Rochester Branch is putting in some hard work to make this a most successful convention from every viewpoint. There will be plenty of educational material, plenty of entertainment for all, including the ladies, and no doubt there will be some important questions for the delegates to consider.

There seems to be a misunderstanding in some branches regarding representation, therefore the following extracts from Constitution:

ARTICLE IX.

Section 1. Each Branch Society shall be entitled to three (3) representatives in the Supreme Society.

Sec. 2. These representatives must be active members and shall be elected one month previous to Annual Meeting of Supreme Society.

Sec. 3. Any member who is an officer in the Supreme Society must be elected by his respective Branch as a member of the Supreme Society.

ARTICLE X.

Section 4. Any Branch Society not sending a delegate to the Convention or to the Annual Meeting of the Supreme Society can empower a delegate of another Branch Society to act in its behalf, provided that no delegate of that Branch Society has been empowered to act as the representative of any other Branch Society.

IMPORTANT

We request that all reports from branches for June issue be mailed so as to reach Editor not later than June 12th.

PRINCIPLES OF ELECTRO-PLATING. II.*

(By Dr. O. P. Watts.)

(Continued from March Monthly Review)

Faraday's Law

If three jars, containing respectively solutions of the double cyanide of silver and sodium, nickel sulphate, and copper sulphate, be connected in series, and current be passed through the cells until 108 grams of silver has been deposited in the first cell, it will be found that 59 grams of nickel and 31.5 grams of copper have been deposited in the other cells.

The CHEMICAL EQUIVALENT of any element is its atomic weight divided by its valence. In the above solutions the valence of silver is one and that of copper and of nickel is two. Turn to the table of atomic weights and compute the chemical equivalents of silver, nickel and copper; it will be found that the weights of the three metals stated above for the deposits are the same as their chemical equivalents. This important discovery was made by Faraday, and is now known as his law.

Faraday's Law. "The weight of material dissolved or deposited at either electrode is proportional to the current, to the time and to the chemical equivalent of the substance."

This is the most fundamental law of electro-plating.

Quantity of electric current is found by multiplying the current in amperes by the time in hours, and is called AMPERE HOURS. Ten amperes for one hour, five amperes for two hours and two amperes for five hours all denote the same quantity of electricity, and should deposit the same quantity of any one metal from solution. It requires 26.8 ampere hours to deposit one GRAM EQUIVALENT (chemical equivalent expressed in grams) of any substance.

From Table 1 find the chemical equivalent of nickel in grams. Computations in plating are most easily made in the metric system, therefore measure electrodes in decimeters, volumes in cubic centimeters or liters, and weights in grams or kilograms; if results must be expressed in English units make the conversion last.

Problems

1. How many ounces (av.) will be deposited per hour by a current of 40 amperes?

Solution: 40 amp. for 1 hour equals 40 ampere hours. Since 26.8 amp. hours deposits 108 g. of silver, the deposit by 40 amp. hours will be.

$$108 \times 40/26.8 = 161.2 \text{ grams.}$$

From page 2 find the number of grams needed to make an ounce, then find the number of ounces in 161.2 g. Ans. 5.7 oz.

2. How many pounds of nickel are deposited by a current of 300 amperes in eight hours?

Solution: Find from Table 1 the weight of nickel deposited per ampere hour, multiply by the number of amp. hours, divide by 1000 to reduce to kilograms; multiply by the number of lbs. in

*Rights reserved by Dr. O. P. Watts.

1 Kg. Ans. 5.9 lbs..
51 lbs. 14 oz.

3. How many pounds of nickel is dissolved from the anodes per eight-hour day in a plating shop that uses an average of 5000 amperes for nickeling? Ans. 96 lbs.

4. How much copper is deposited from the cyanide solution on a lot of steel builders' hardware that required the operation of two plating tanks at 100 amperes each for ten days to fill the order? Ans. 10.4 lbs., or 10 lbs. 6½ ozs.

It sometimes happens that two metals are deposited at the same time from a plating solution, in which case the total weight of metal deposited agrees with the amount required by Faraday's law; and therefore the weight of either metal alone must be less than called for by Faraday's law. The deposition of brass is an example of this.

Instead of the simultaneous deposition of two metals, a single metal and hydrogen may be deposited; in this case the total weight of hydrogen and metal is equivalent to the current used, but obviously the amount of metal is less than that calculated from the current and time by Faraday's law. Such deposition of hydrogen along with the metal is seen in the cyanide copper solution.

Faraday's law only states that the total of chemical changes at the anode and at the cathode is proportional to the current, time, etc.

CURRENT EFFICIENCY.

The plater values only the deposition of metal, hence any part of the current spent in plating out hydrogen is wasted. The term CURRENT EFFICIENCY is used to denote that fraction of the current which is spent in the particular change that it is desired to accomplish.

If in copper plating the current deposits nothing but copper, and none of the deposited copper is being dissolved by the electrolyte, then the amount of metal added to the cathode will be exactly that calculated by Faraday's law from the current and time; the efficiency of deposition is 100%. If, however, a part of the current is wasted in depositing hydrogen, the efficiency of deposition of copper must be less than 100%. The efficiency can be found by weighing the copper actually deposited, and dividing this by the weight of metal calculated by Faraday's law from the ampere hours used. The grams of metal per ampere hour in Table 1 are calculated by Faraday's law.

There are evidently two ways in which the efficiency of plating solutions may be less than 100%—either by a part of the current being spent in depositing at the cathode something besides the desired metal, or by there being present in the electrolyte some chemical which corrodes or dissolves the metal after it is deposited. Of course, both of these actions may go on at the same time, and cause a very low current efficiency.

The effect of even a moderate amount of acid in some plating solutions may be shown by dividing a small amount of nickel bath into two parts, adding to one portion one volume

of conc. sulphuric acid for each 250 volumes of solution, and operating the two baths in series with weighed cathodes. The current and time should be carefully observed, and evolution of hydrogen noted. Compute the current efficiency of each solution by dividing the weight of metal deposited by that calculated by Faraday's law.

The same proportion of sulphuric acid could have been added to a copper sulphate solution with scarcely any reduction of the current efficiency. The reason for this difference in the effect of acid in nickel and copper solutions will be explained later.

An increase of the free cyanide in copper and brass solutions has a similar effect in diminishing the efficiency of deposition of metal by causing a considerable fraction of the current to be wasted in the plating out of hydrogen.

The efficiency of the dissolving of anodes may be made to exceed 100% by adding to the electrolyte some chemical capable of corroding the anode. This is the case in copper refineries, in which the electrolyte contains about 12% of free sulphuric acid.

It is seen that for the passage of any particular amount of electricity through a solution a definite quantity of one or more materials must be discharged from the solution at each electrode. It is like the taking of tickets at a theater; the electrodes are the doors ,and no electric current can pass through without giving up its ticket, i. e., depositing a definite amount of material at the door through which it passes.

From Faraday's law it is seen that every gram equivalent of all substances in solution carries the same amount of electricity.

Problems.

5. If the current efficiency in problem No. 1 was only 90%, what weight of silver was deposited?

Solution: As calculated for 100% efficiency the weight was 5.7 ozs.; at 90% efficiency the weight of silver would be 90% of 5.7, or 5.13 ozs.

6. If in problem No. 2 the current efficiency were 92%, what weight of nickel would have been deposited?

Answer: 5.4 lbs., or 5 lbs. 6½ ozs.

7. The current efficiency of a cyanide copper solution is always less than 100% on account of the free syanide present; if the current efficiency in problem No. 4 was 80%, how much copper was actually deposited on the hardware?

Answer: 8.32 lbs., or 8 lbs. 5 ozs.

Ohm's Law.

The amount of current which flows in any electric circuit does not depend solely upon the voltage (electric pressure) applied, but also, and to an equally great extent, upon the resist-

ance of the circuit. The relations of current, voltage and resistance are expressed in Ohm's law.

Ohm's Law:—"The current varies directly as the electromotive force, and inversely as the resistance of the circuit."

Let I equal the intensity of the current in amperes, E the electromotive force in volts, and R the resistance in ohms; then

(1) $I=E/R$.

By finding the values of E and of R in the above, equations (2) and (3) are obtained.

(2) $E=IR$. (3) $R=E/I$.

Whenever two of the three quantities, E, I or R, are known the third may be found by a simple computation.

Equation (2) not only gives the voltage required to send the current "I" through a circuit whose resistance is "R" but it applies to any part of a circuit. In any electric circuit the total voltage or E. M. F. is distributed over the various parts of the circuit (cables, rheostat, electrolyte, etc.) in proportion to their resistances.

Suppose the resistance of the cables in a six volt circuit to be 0.01, of the plating tank 0.03, and of the rheostat 0.02 ohms, how will the six volts be distributed in the three parts of the circuit?

Solution: The total resistance is $.01+.03+.02=.06$ ohms By equation (1) the current equals 100 amperes.

By equation (2), IR for the cables is one volt, for the tank three volts, and for the rheostat two volts.

An examination of these results shows that the "fall of potential" or voltage absorbed by the different parts of the circuit is in the same proportion as the resistance of these parts. This is true of every electric circuit.

Problems.

8. The resistance of a nickel placing solution is 0.021 ohms, what current will pass through it at a pressure of three volts?

Use equation (1). Answer: 147 amperes.

9. If the dynamo voltage was six in the previous problem what was the resistance of rheostat and cables when adjusted so that three volts was impressed on the plating tank?

Solution: Since that part of the total voltage not impressed on the tank must have been absorbed by the remainder of the electrical circuit, the cables and rheostat must have absorbed 6—3=3 volts. Use equation (3) to find R.

Answer: 0.021 ohms.

10. A plating tank 50 feet from the dynamo is connected to it by a 0000 copper cable, having a resistance of 0.0489 ohms per 1,000 ft. What voltage is lost in the cable when 300 amperes is used in the plating tank?

Use equation (3). Answer: 1.47 volts.

11. On a six-volt circuit a plating tank of 0.02 ohms resistance is connected through cables of 0.01 ohms resistance. When the tank is operated with two volts what is the current?

Use equation (1).

What is the resistance of the rheostat?

Solution: After finding the current, compute the volts absorbed by the cables; if to this the 2 volts applied to the tank be added the result will be the entire voltage, except that absorbed by the rheostat: find the volts absorbed by the rheostat, knowing this and the current, the resistance of the rheostat can be computed by equation (3).

Answer: Current, 100 amp. res of. rheostat, 0.03 ohms.

12. More work is now placed in the tank of problem 11, and in consequence its resistance drops to 0.008 ohms, and it is found necessary to adjust the rheostat in order to maintain 2 volts on the bath. What current is now flowing? What is the resistance of the rheostat in its new setting?

Answer: 250 amperes; 0.006 ohms.

The resistance of a plating bath is easily measured by taking readings of current and voltage, and applying equation (3). The passage of current through plating solutions usually develops a slight E. M. F. in the opposite direction (counter-electromotive force), which partly nullifies the E. M. F. impressed on the tank, so that only a part of the E. M. F. read on the voltmeter is effective in sending current through the solution. The amount of this counter—E. M. F., or POLARIZATION—must be noted and allowed for in applying Ohm's law to finding the resistance of a plating tank.

The method is as follows:

With the usual amount of work in the tank, read the pressure in volts and the current in amperes, then with the voltmeter still connected across the suspension rods of the tank, open the circuit by means of a switch or the rheostat, and at once read the voltmeter, which will probably register between 0.01 and 0.50 volts.

From the pressure in volts subtract the polarization (second reading of the voltmeter). The remainder is the E. M. F., which is effective in sending current through the electrolyte. Divide this by the current, and the quotient is the resistance.

In this manner find the resistance of several plating tanks. It will be found that the resistance diminishes as the number of anodes and objects that are being plated is increased. A rise in temperature also causes a considerable decrease in resistance, so that at the same voltage a much larger current is obtained through the same solution when hot than when cold.

Measure the resistance of some plating tank, both cold and hot, recording the temperatures, and having the same anodes and cathodes in both cases. The resistance hot is what per cent of the cold resistance?

Resistivity.

The resistance of any conductor increases in proportion to its length and diminishes as the cross section is made larger, in exact proportion to the increase in area. In the case of wires the area varies as the square of the diameter, so that doubling the diameter divides the resistance by four, increasing the diameter three-fold divides the resistance by nine, etc.

In order to compare the resistances of different substances it is evidently necessary not only that the materials have the same volume, but also that they have the same shape. The cube has been adopted as the standard form; in the metric system, a cube each edge of which is one centimeter; in English measure, the inch cube. The resistance between any two parallel faces of the cube is called the RESISTIVITY or SPECIFIC RESISTANCE of that substance. A solution having a high resistivity is a poor conductor, and one having a low resistivity is a good conductor.

For measuring the resistivity of a solution it is necessary to put it into a vessel of regular shape, whose length and area of cross section can be readily measured.

Measure the resistivity of several plating solutions as follows:

The apparatus needed consists of a rectangular wood box about 12" x 6" x 6" (the exact size is not important), a voltmeter of 6 volt range, and an ammeter having a scale of 4 or 5 amperes, and a switch.

Cut two sheets of metal (if possible of the same metal as that of the solution whose resistivity is to be measured) to exactly fill the small ends of the box, nearly fill the box with the plating solution, and connect the electrodes through the switch, ammeter, and a rheostat to the dynamo; connect the voltmeter to the electrodes.

Close the switch, read the E. M. F. and current, then open the switch and at once read the voltage again; this is the polarization.

From the E. M. F. subtract the polarization and divide the remainder by the current in amperes; the quotient is the total resistance of the solution. To find the resistivity, measure the distance between the electrodes carefully in centimeters, also find the area in square cm. of that part of an electrode (one side only) which is immersed in the electrolyte; this equals the cross section of the electrolyte.

$$\text{Sp. R.} = \text{R.} \times \text{area/length.}$$

Divide the total resistance found above by the length and multiply by the area; the result is the resistivity per cm^3.

If the resistivity per inch cube is desired, measure all dimensions in inches.

In addition to the salt of the metal which it is desired to deposit, and which is the essential constituent of the bath, it

has been the custom of platers to add other substances, usually called conducting salts, which may or may not add to the conductivity.

A comparison of the resistivities (table 3) of substances used in plating shows that the mineral acids (sulphuric and hydrochloric) are by far the best conductors, that the alkalines (KOH and Na OH) are nearly as good conductors as the acids, and that the salts are much poorer conductors than the foregoing. There is, however, a great difference in the conducting power of different salts, the sulphates, chlorides, and nitrates of potassium, ammonium and sodium having the lowest resistivity. The resisitvity of solutions diminishes with increase of concentration up to a certain point, then increases again, so that a saturated solution is not always the best conductor. For salts which are soluble only to the extent of 250 to 300 grams per liter a saturated solution is usually the best conductor; but for extremely soluble substances, such as $Ca\ Cl_2$, $Mg\ Cl_2$, $Zn\ Cl_2$, $Mg\ SO_4$, $Na\ NO_3$, K_2CO_3, etc., the conductivity improves for a time as the concentration is increased, but presently reaches a maximum, and with further increase in concentration the conductivity diminishes up to saturation.

The amount of current that can be used in a plating solution is limited by the amount of anode and cathode surface in the bath, since too large a current per square foot of surface (i. e. too high a current density) spoils the deposit or causes the corrosion of anodes to be unsatisfactory. The addition of any substance for the sole purpose of improving the conductivity is usually unnecessary, since plating baths are rarely operated at more than half the voltage of the dynamo; any increase of current desired can be obtained by cutting out more of the rheostat instead of adding conducting salts. Only in cases where the cables running to the tanks are so small that the IR, drop ($E=IR$) absorbs too large a proportion of the voltage of the dynamo, or with some of the new solutions that are designed to be operated at extremely high current densities should it be necessary to add anything to the electrolyte to lower the resistance.

Distribution of Current Density on Anode and Cathode.

One well-known effect of Ohm's law is the uneven distribution of current on the electrodes, resulting in a deposit which varies greatly in thickness. If the plating tank contains only one anode and one cathode it will be found that the current flows, not only in that part of the electrolyte which lies directly between the electrodes, but spreads out even to the ends of the tank. The proportion of the total current which passes through the various paths between the electrodes is determined by their resistance, which depends upon the relative length of the paths. The current density in the electrolyte will be highest in that part which forms the shortest path between the electrodes,

and will be least in that section which constitutes the longest path. All current which leaves the anode must converge again at the cathode, however far it may have deviated from the straight path. The result of this is that the edges, and particularly the corners, receive a larger part of the current, which has spread out along the ends and bottom of the tank, than does the central portions of the cathode; since the edges and corners receive their full share of the current which passes directly across between the electrodes, this extra proportion of current from the ends and bottom results in a higher current density at these places than elsewhere on the cathode.

If plating on a piece of sheet metal be continued for 24 hours or more, so that the increased thickness of metal is visible, it will be found that corners and edges have received much more than the average thickness of deposit. Since the time, and probably the current efficiency have been the same for all parts of the cathode, the difference in thickness can only be due to differences in current density.

The same principle governs the distribution of current at the anode, where the current density is much higher on corners and edges than elsewhere; this results in a more rapid dissolving of the anodes at these places.

Examine several anodes in a half dozen different plating tanks.

The only way to secure a uniform current density on a flat anode is to have both electrodes of such size that they completely fill the ends of the plating tank. Then all the current flows directly across, and there is none of the spreading out and converging of current which is responsible for an uneven current density. To secure a deposit of fairly uniform thickness on an object of irregular shape a rearrangement of anodes may be necessary or anodes of special shape may be required.

Ideal Plating Bath.

When a plating bath is made up it contains the various materials which experience has shown to be best suited to the purposes of that particular bath. In order to maintain it in the best condition it is necessary that its composition shall not be changed; this means that as fast as metal is deposited exactly the same weight of metal should dissovle from the anodes; in other words, that the current efficiency at anode and cathode shall be equal.

If the current efficiency of a cyanide copper bath is 70%, i. e., 30% of the current is wasted in liberating hydrogen, then to supply the metal as fast as it is being removed the efficiency at the anode ought also to be 70%, and 30% of the current should be wasted here in the liberation of oxygen. When the current efficiencies at anode and cathode are equal the original

acidity or alkalinity of the bath is maintained, but if the efficiency at the cathode exceeds that at the anode, so that more metal is removed than is added, the bath becomes acid; if the efficiency at the anode is greater than at the cathode the bath tends to become alkaline. The desirability of keeping equal current efficiencies at the two electrodes is apparent.

Within limits the relative current efficiencies at anode and cathode may be controlled by regulating the current density; a high current density tends to lower the efficiency, and a low current density tends to raise the current efficiency nearer to 100%. If a nickel solution, as regularly operated, tends to become acid and needs frequent additions of nickel carbonate to keep it neutral and to maintain its original strength in nickel, more anode surface should be provided so that the current density at the anode will be lower. If too much metal is supplied by the anodes, so that the faint acidity which some solutions need for proper working is destroyed, then the current efficiency at the anode is too great and it should be lessened by taking out some of the anodes and so raising the current density.

Even when anode and cathode efficiencies are equal, plating solutions change in composition because of the electrolyte carried out on the work when this is removed from the tank. The amount of this loss depends on the amount of surface plated, but may amount to considerable, and will finally render the solution too weak for satisfactory use unless metal is added from time to time as a salt, or some chemical is used which which will cause the anodes to supply slightly more metal than is being deposited.

(TO BE CONTINUED)

*Rights reserved by Dr. Watts.

COLD TRUTHS

Friction is stalling success. Lack of co-operation is costing this country its rightful place on the producing map of the world.

Men are war weary and peace mad.

We shall continue to pay the highest cost of living until we agree to work together.

Get that Prosperous Look.

He who works when he does not have to work will not have to work when he does not want to work.

A man is what he is, not what other folks say he is.

In all your dealings remember that today is your opportunity; tomorrow some other fellow's.

GALVANIZING OF ALUMINUM.

At the preceding meeting the question arose as to the best method of electro-galvanizing aluminum, so I am relating some of my experiences along this subject.

As I was connected with a jobbing shop, a manufacturer brought in some aluminum arch supports that required electro-galvanizing. I had them cut down with Tropoli composition, then colored up with white lime composition, as you would any other work, then I cleaned them in a boiling hot sal soda solution, one pound sal soda to the gallon of water, let the articles hang in the hot solution for a minute and a half. Then, taking them out, I had them rinsed in cold water and scrubbed with pumice stone, then direct to the zinc solution, composed of one pound zinc sulphate and one pound sal ammoniac to the gallon of water. With a voltage of TWO volts I left the articles plate for forty-five minutes. I then dried, and colored up on a twelve-inch buff at a speed of 2200 R. P. M. with the white lime composition The articles stood a good cutting down with no signs of peeling.

ABRAHAM KANTROWITZ.
Pittsburgh Branch.

NICKEL SOLUTION FOR PLUMBING SUPPLIES.

By Fred Luzius.

By request of Cleveland Branch, I will give a formula of a solution I use on plumbing supplies, which simply consists of double-nickel salts and sal ammoniac.

In making up this solution, I fill the tank about one-third full of water, then after dissolving the nickel salts add it to the water until it registers 6 or 6½° Beame. Keep the solution well stirred. The sal ammoniac is then added. I use 1 pound to every 100 gallons of solution, and dissolve it in hot water and pour along anodes while the current is on. This solution should be stirred up frequently to eliminate any precipitation. Sal ammoniac being a good conductor also keeps the anodes well open and thus speeds up the plating. I keep the bath slightly acid and find the deposit soft and easy to buff. I use 2-2/5 volts for polished work and 3 volts for rough, white work.

The man who invests in more knowledge of the business than he has to have in order to hold his job, has capital with which to buy a mortgage on a better one.

Heaps ob fellows think dey hab life insurance foh deir famlys when dey hab only enough to protec' de doctah an' de undehtakeh.—Rough Notes.

ELECTRO DEPOSITION OF COPPER UPON WAX. II.

By Royal F. Clark.

(Continued from April.)

PRIMARY BATH FOR MOTHER MATRIX

Copper Sulphate	32 oz.
Sulphuric Acid C. P.....	1 oz.
Distilled Water (to make)....	1 gal.

A current of 8 amperes is used at first and gradually increased until 24 amperes is reached. When the shell is of sufficient thickness to remove from the bath without any danger of it being affected, it is transferred to the secondary bath.

THE SECONDARY BATH

Copper Sulphate	32 oz.
Sulphuric Acid C. P.....	3 oz.
Distilled Water	1 gal.
Casein Glue.....	?

A current of 20-24 amperes is employed. The run is for 18 hours. The weight of copper for this shell, which is called the Mother matrix, is:

10"	16½ oz.
12"	18½ oz.

The Master matrix is separated from the Mother matrix, is well cleaned and stored away in a suitable container, so that it will not be scratched.

The Mother matrix is cleaned, trimmed and mounted by the same method as was used for the Master matrix. As this is the reverse of what is required for a Stamping matrix the same operations are repeated that was necessary to obtain the Mother matrix. The same solutions are used and the same precautions are necessary.

The weight of the Stamping matrix is:

10"	10¾ oz.
12"	15½ oz.

The Stamping matrix after trimming and cleaning is mounted on a copper disc. This is accomplished by painting the face of the shell with ivory soap and vaseline to prevent oxidation, and then placing the shell on a suitable heater and tinning the back and then soldering it onto the copper disc.

As the copper face is not hard enough for stamping the whole shell is given a light nickel plate. The surface of the copper must be thoroughly cleaned or the nickel will leave the face of the copper shell during the stamping operation

NICKEL SOLUTION

Nickel Ammonium Sulphate...	4 oz.
Nickel Sulphate.....	12 oz.
Sodium Chloride.....	1½ oz.
Boric Acid.....	2 oz.

A current of about 5 amperes per shell is employed and the run is for 20 minutes.

Sometimes the nickel is deposited directly upon the Mother matrix. The nickel shell is light, probably never over .002" thick. Copper is deposited upon the nickel until the required thickness is obtained.

In this method the operations are the same up to and and including the silvering. Instead of using the iodide for separation, sodium bi-chromate is employed.

SODIUM BI-CHROMATE SOLUTION

Sodium bi-chromate is added to distilled water until a density of 1°Be. is reached.

This solution is more stable than the iodide solution and can be used for a longer period. It is, however, advisable to make a new solution instead of building up an old one by additions of fresh chemicals.

When preparing the disc for plating it is necessary to use a stopping off wax to prevent the copper from depositing over the edges. The wax is applied warm.

STOPPING OFF WAX

Beeswax	2 lb.
Paraffine wax	1 lb.
Rosin	10 lb.

Hard rubber jars are preferable to glass jars for plating solutions as they are not so liable to breakage. The dimension used:

12" Record 16¾" x 12½" x 18" = 14 gal.
10" Record 13½" x 10¼" x 15½" = 8 gal.

*All rights reserved by New York Branch.

CORRECTION

There is a slight error in an article written by J. Kretschmer, in the March Review, and I am sending in the correction.

On page 6 the last paragraph should read as follows:

"A burette is rinsed once or twice with a little of the H_2SO_4 solution and filled to the O mark. 10 c.c. of the alkali solution is poured into a 25 c.c. beaker and a few drops of methyl-orange added, also about 10 c.c. H_2O. Now bring this under the burette and add the H_2SO_4 a drop at a time until the color just turns red; note the number of c.c. used, then calculate the amount of H_2O to be added, as follows: Suppose 9.5 c.c. had been used on 10 c.c. of the alkali, then each 9.5 c.c. of the acid solution must be diluted to 10 c.c., or by proportion the amount of H_2O to be added is calculated as follows: 9.5 : 10 :: 1000 : x. x. = 1057.63. The acid is too strong and each 1000 c.c. must be diluted to 1057.63 c.c.

J. C. KRETSCHMER.

WHAT THE BRANCHES ARE DOING

Bridgeport.

Meets third Friday of each month in its laboratory, 260 John St., Bridgeport, Conn. Secretary, Royal F. Clark, P. O. Box 671, Bridgeport, Conn.

Our April 16, 1920, meeting was held in the laboratory, with 16 members present, President J. M. Dunn presiding, and our Secretary, after an absence of six months, living in Brooklyn, back at his desk. His duties while away were very ably filled by the Assistant Secretary, Louis J. Maraffi.

After the routine of business was dispensed with, and under "Good and Welfare," the President called on Secretary Clark for a talk on some topic. He responded by giving his experience with the deposition of copper upon wax for the making of phonograph matrices, also "Bright Nickeling," using a cadmium anode. Samples of flat steel articles were shown, having received a 3½-hour deposit in a plating barrel, which were extremely bright.

Discussion on the use of hydrofluoric acid in a nickel bath was participated in by Messrs. Barnard, of Great Barrington, Mass.; Scame and Theriault, of So. Norwalk. All were glad to see so many out-of-town members, but missed our old "stand-bys," Messrs. Hogaboom and Johnquest from Waterbury, Conn.

A meeting of the Banquet Committee was held and the result was that if Dr. Blum could be secured to deliver his illustrated lecture on May 15, 1920, in the afternoon, we also could hold our banquet that same evening at the Stratfield. A letter from Dr. Blum arriving on the night of our meeting stated that May 15 would be convenient to him for his lecture. So it seems quite likely that if the Hotel Stratfield Banquet Hall can be secured May 15 our banquet will be held on that date.

Meeting adjourned at 10 P. M.

ROYAL F. CLARK, Secy.-Treas.

P. S.—Ten of our members have ordered A. E. S. pins (the special small size), rolled gold, 68c; 10-karat gold, $1.84, and 14-karat. $2.10—5% war tax is included in above prices. Any other members of Bridgeport Branch who desire please send their orders in at once to the Secretary.

Chicago

Meets second Saturday of each month, 8 p. m., at the Briggs House, Randolph and Wells Sts. Secretary, R. J. Hazucha, 4224 W. 20th St., Chicago, Ill.

Our last regular meeting was held May 8th with President Binder presiding. This being election night there was an unusually good attendance. There was a discussion again in regard to papers for the convention, and there were two or three more members who volunteered to do their bit, so we are now assured of having several good and interesting papers.

The election of officers resulted as follows:

President—C. E. Thornton.

Vice-President—George Burt.

Secretary-Treasurer—R. J. Hazucha.

Librarian—F. J. Liscomb.

Board of Managers—F. J. Hanlon, Charles Posbeck, W. G. Meggers.

Delegates to Convention—O. E. Servis, J. H. Hansjosten, C. E. Thornton.

Alternates—R. J. Hazucha, F. J. Hanlon, Charles Posbeck.

On account of the election of officers taking up so much time, the educational program was dispensed with until next meeting, but the question box contained the following questions, which were discussed:

Question No. 1—My nickel solution plates with a dead white matte, what can I do to brighten the deposit?

Answer—Add 6 oz. single salts, and 2 oz. boric acid to each gallon of solution.

Question No. 2.—What is a good formula for a gold solution that will plate by immersion?

Answer—Any good working gold solution, diluted and heated to boiling will deposit gold by immersion on brass, providing there is not too much free cyanide in the solution. This action is due to the galvanic action between the zinc contained in the brass, and the gold.

Question No. 3.—What is the cause of the current reversing in a generator, and what is the remedy?

Answer—When a generator is pulling a heavy load and stops suddenly for any reason, such as blowing of a fuse or breaking of a belt, the tanks act as storage batteries and the current is rushed back to the field and reverses the current. The remedy is to excite the field with storage batteries or any D. C. current.

Cincinnati

Meets on the first and third Friday of each month at Dennison Hotel. Secretary, W. J. Husing, 729 McMakin Ave., Cincinnati, O.

We extend to you a cordial invitation to be present at the Second Annual Banquet of the Cincinnati Branch of the American Electro-Platers Society, to be held Saturday, May 15, 1920, at 7:45 P. M., at Chamber of Commerce.

Mr. F. C. Broeman, our Cincinnati Industrial Chemist, will address us along the lines that should exist between the plater and the chemist.

Mr. Geo. K. Elliott, Chemical Engineer of the Lunkenheimer Co.; also Dr. Fred W. Weissmann, Director of Lectures of the University of Cincinnati, will address those present.

The following committee have arrangements in hand: F. Nordman, Wm. J. Husing, Thos. Whitehead, Frank Farmer, Jos. Adler, Thos. Buchanan, F. C. Broeman.

Detroit

Meets first Friday in each month at Cass Technical High School, Platers' Classroom, 2nd Avenue and Beech Street, at 8 p. m. Secretary, E. G. Lovering, 562a Grand River Avenue, Detroit, Mich.

Regular meeting of Detroit Branch was held May 7th, with President Fritz in the chair and a good attendance present.

Communication read from Grand Rapids Branch asking for transfer for Mr. Charles O. Werft, and same was granted.

Application for membership from Mr. James McPartland.

General discussion on electrolytic nickel anodes and samples were exhibited. Detroit Branch believes that electrolytic nickel anodes will soon be used extensively.

Mr. Liscomb's article which appeared in a trade journal, on removing carbonates from cyanide solutions, was discussed, and Detroit Branch wishes to congratulate Mr. Liscomb, or "DAD," as we say in the Classics, on his most interesting article. "More power to Ye, Dad."

An interesting experiment was carried out by our research committee at our laboratory at Cass School with Magic Fluid. 400 C.C. of solution was made up in a beaker and a pure electrolytic nickel anode used. They deposited .433 grams of nickel on the cathode and took off .460 grams of nickel from the anode in 10 minutes with 2.3 amperes flowing. This is food for thought.

The following officers were elected: President, George Kutzen; Vice-President, L. P. Brockway; Secretary, E. G. Lovering; Librarian, A. F. Norgen; Sergeant-at-Arms, Al Jones; Board of Managers, Mr. Brockway, Mr. Seeley, Mr. Fritz; Delegates to the Convention, E. G. Lovering, H. S. Brockway, A. J. Fritz.

New York

New York Branch of the American Electro-Platers' Society meets every second and fourth Fridays of each month at the Broadway Central Hotel Parlors, New York, N. Y. Secretary, John Burke, 110 Glen St., Brooklyn, N. Y.

April meetings of the New York Branch of the A. E. S. were well attended, President Sterling presided. Four applicants were elected to membership; one associate and three active. Under miscellaneous discussions the following subjects were discussed: Chemical coloring of Galvano plastic articles. The value of the Ammeter in the plating room. Silvering mirrors for the optical trade. Laboratory Chairman Mr. Haas gave a very interesting and instructive talk on the generation of the electric current and its consumption in the electrolyte.

Notice—On account of over a 100% rental advancement demanded for our present laboratory and meeting room, New York Branch of the A. E. S. wishes to announce to its members that the regular 2nd and 4th Fridays' meetings will be held at the parlors of the Broadway Central Hotel, Broadway and Seventh St., New York, N. Y. The Tuesday nights laboratory sessions will be held at the Stuyvesant Trade School, 16th St., near First Ave., New York, N. Y.

Grand Rapids

Meets on the second Wednesday of the month at The Morton House. Secretary, J. B. Hawley, 130 Stewart St., Grand Rapids, Mich.

The regular meeting was held April 14th, at the Morton House, and was well attended. Professor Keith Kennedy being present informed us that there was a new high school in course of construction and advised us to get busy and see if we could secure a class room. A motion carried that there be a committee of three appointed to meet the school board and see if arrangements could be made. Committee: Professor Kennedy, Mr. Knap and Mr. Whalley.

A motion carried that the President appoint a committee including himself to nominate candidates for the coming election of officers. Committee: Mr. Allen, Mr. Oates and Mr. Whalley.

A motion carried that the application fee be raised to $5.00.

On May 14th the regular meeting was held at the Morton House and the following officers were elected for the next term: President, Walter Allen; Vice-President, Henry Van Slueters; Secretary-Treasurer, J. B. Hawley; Librarian, Charles S. Whalley; Board of Managers, Charles Poe, Wm. Fitzsimons, A. Rickson.

St. Louis.

Meets third Saturday of each month at Barr Branch Library, corner Jefferson and Lafayette. Secretary, H. H. Williams, 4156 Botanical Ave., St. Louis, Mo.

On May 15th we held a very interesting meeting, first, we had a good attendance and then it seemed that everyone took a part. The fact that our librarian was re-elected is proof that our meetings have the right spirit. The officers elected for next fiscal year are: President, C. L. Weygandt; Vice-President, C. T. McGinley; Secretary-Treasurer, H. H. Williams; Librarian, G. Lamkemeyer; Board of Managers, E. J. Musick, F. E. Terrio and G. Brandt. Delegates to convention, E. J. Musick, H. H. Williams and E. W. Heil; Alternates, C. T. McGinley, H. Deubelbeis and F. N. Weber.

Mr. C. Puffer, of Rochester Branch, now located in St. Louis, was a visitor, as was Harold W. Faint, an electro-chemist, a son of E. W. Faint of Newark Branch, who is also located in our city. We welcome all visitors. Two applications for membership were received.

Providence-Attleboro.

Meets first and third Thursdays of each month at 26 Custom House Street, Room 16. Secretary, Clayton J. Poyton, 269 Ohio Avenue, Providence, R. I.

Rochester

Meets on the fourth Fridays. Secretary, Sylvester Gartland, 128 Bryan Street, Rochester, N. Y.

Our last meeting was held April 24, with President Hesselink presiding.

One application for active membership was received. This was referred to the Secretary for references.

The question of anode hook protection was taken up by Frank Speary, who exhibited to the members a small metal hook protector that was used on a hot copper anode rod for six months and showed no signs of corrosion.

The Convention Committees report all arrangements for the 8th Annual Convention are coming along fine.

Newark.

Meets first, third and fifth Fridays of each month, 8 p. m., Foresters' Home, 20 Central Ave., Newark, N. J. Secretary, O. F. Carlson, 225 West Grand St., Rahway, N. J.

The committee in charge of the banquet, held by the Newark Branch, American Electro-Platers' Society, at Achtel-Stetter's, Saturday evening, April 10, 1920, made a promise that this would be the best banquet ever held by any branch, and that there would not be a dull moment from the start until the last person left the hall, and the committee has made good its promise.

In spite of the railroad strike, shortly after 8 o'clock, 163 persons sat down to enjoy an elaborate menu.

Then the entire assemblage stood up and sang the Star-Spangled Banner. President Matts of the Newark Branch made a short address of welcome, and then introduced the toastmaster, Mr. Harry Simmons, city commissioner of Rahway, N. J., who gave a short humorous speech, interspersed with funny stories. Mr. Simmons also said he took this occasion to announce the nature of the surprise which the banquet committee had promised, which was: That a business house of Newark was celebrating its one-hundredth anniversary, and on account of its close affiliation with the plating industry desired its friends to celebrate it with them.

After the speeches the floor was cleared for dancing.

One of the pleasing features of the evening was the "corraling" of Mr. John E. Sterling, president of the New York Branch, and supreme secretary of the A. E. S. and three rousing cheers given for John Sterling and his New York bunch of live wires. Mr. Sterling responded with a short speech.

That the second annual banquet of the Newark Branch was one grand success is surely agreed by all who attended, and was proved by the fact that Mr. Horace Smith, chairman of the banquet committee, wore a smile all evening that will not wear off for some time to come.

Toronto

Meets second Thursday of each month at Occident Hall, Bathurst and Queen Streets. Secretary, Oswald Holtham, 245 University Ave., Toronto, Ont.

Regular meeting held on May 13th, was called to order by President Magill. G. M. Burns, of Montreal, was elected to membership. The election of officers for next term resulted as follows: President, T. O'Keefe; Vice-President, W. H. Cresswell; Secretary-Treasurer, O. Holtham; Librarian, C. Kemish; Sergeant-at-Arms, A. Armstrong; Board of Managers, J. Acheson, C. Kemish and W. Cox. Delegate to 1920 convention, T. O'Keefe.

Question—What is the most serviceable tank for a hot nickel solution, also for a cold silver solution?

Answer—For a hot nickel solution a lead-lined tank with a sub-lining of wood, and for silver a pitch-lined tank were most favored.

It was requested that all members attend our meeting on June 10th, as a subject of much importance to the branch will be discussed.

Philadelphia

Meets first Friday of each month in the Harrison Laboratory Building, University of Pennsylvania, 34th and Spruce Sts. Secretary, Philip Uhl, 2432 North 29th St., Philadelphia.

Philadelphia Branch held its regular meeting on April 2nd, but on account of the storm and not many being present another meeting was held on April 16th, with about ten members being present. Philadelphia Branch has had bad weather on its meeting nights all winter. We have arranged for speakers for all our meetings, but it is poor support to a speaker to talk to ten or fifteen members. These men are capable and deserve better support than given by some of our members. Now, let us get together and by your presence give support to the speakers. Don't be like the man who said he could not get anything out of the meetings; neither could that same man get any interest money out of a savings bank because he never put any money in it to get any interest on.

Election of officers and delegates to the Rochester Convention will be on June 4th.

GEORGE GEHLING.

An event worth while will be the Smoker-Lecture and Get-Together Meeting to be held Saturday, June 5th, 7 p. m., at Lorraine Hotel, Broad St. and Fairmount Ave. Prof. Hiram S. Lukens, of Pennsylvania University, will talk on "Analysis of Solutions for Metal Content," and Henry L. Zucker on "Polishing Compositions." Then there will be music and entertainment. All members of the A. E. S. passing the way of Philadelphia should join with the members of our branch and their employer or superintendent in this event. Tickets at $2.50 can be secured from Secretary or from John B. Fay, 447 Bourse Building.

Pittsburgh

Meets every first Saturday at 8 p. m. at United States Bureau of Mines Building, Forbes St. Secretary S. E. Hedden, 227 5th St., Aspinwall, Pa.

PITTSBURGH BRANCH TO THE FRONT.

"There is nothing like being young and full of 'go'."

Pittsburgh Branch is "the baby branch, but by no means the smallest." They are good at entertaining as well as at the plating business.

On Saturday night, April 17th, fifty-four ladies and gentlemen, members, their wives and guests, sat down to a sumptuous banquet at the Fort Pitt Hotel.

The City of Pittsburgh was officially represented at this banquet by Robert Garland, one of the Councilmen. Norval Daugherty responded in behalf of the society. S. E. Hedden, Secretary of the Pittsburgh Branch gave a concise history of the same. Richard Sliter made a few very interesting remarks. Arthur H. Roberts entertained all those present most instructively by his lecture, "Humanity and Industry."

This banquet has been productive of great good in the way of applications of some of the most representative platers in the Pittsburgh district.

Mr. John Corbit, President of the Branch, was Toastmaster. Abraham Kantrowitz was master of ceremonies.

The Program Committee turned in a handsome amount as the result of advertisements sold.

WILFRED S. McKEON, Chairman.

The attendance at our meeting of Saturday, May 1st was held down on account of May 1st being moving day in Pittsburgh. After the regular business was taken care of, President John Corbit announced that, as this would be the last meeting of the fiscal year, it was in order to nominate and elect new officers for the coming year, 1920-1921, also nominate and elect delegates to the Convention to be held in Rochester. The following were nominated to serve for the new year: President, John Corbit; Vice-President, A. Kantrowitz; Secretary-Treasurer, S. E. Hedden; Board of Managers, Elliott S. Corbit, Joseph Weigand, William A. Fuller; Delegates to the Convention: Wilfred S. McKeon, S. E. Hedden and Elliott S. Corbit; Alternates, John Corbit, A. Kantrowitz and Clarence E. Eggleston. As there were no opposition to any of the officers, President Corbit ordered all elected by acclamation.

Two applications for membership were received and one elected to membership.

Mr. John Corbit announced that our member, Mr. J. L. Jones, of the Westinghouse Electric & Mfg. Co., had made arrangements with his company to make an analysis of any plating solution free of charge, he and the company wishing to be of some help to the members. This will be greatly appreciated.

Indianapolis

Indianapolis Branch holds its business meeting the second Saturday in each month at Hotel Denison. Secretary, Louis Mertz, 1725 Union St., Indianapolis, Ind.

Indianapolis Branch held its regular meeting May 8th with a poor attendance. The following officers were elected: President, R. Hennessey; Vice-President, F. McDonald; Secretary-Treasurer, L. Mertz; Librarian, B. D. Aufderheid; Board of Managers, G. Becktel, F. McDonald, R. McCracken. Delegates to Rochester Convention are: B. D. Aufderheid, George Barrows and Charles Howard. Alternates: L. Mertz, R. Hennessey and Wm. Wright.

Milwaukee

Meets first Friday of each month at West Side Bank Building. Secretary, A. W. Ruttan, 1105 Twenty-eighth St., Milwaukee, Wis.

At our meeting May 7th we had a large attendance on account of nomination of officers. A motion was passed that the Board of Managers make arrangements for a picnic for the members and their families, to be held at Grafton, Wis. We will all motor there, it is about 25 miles from Milwaukee.

At last we have a class in electro chemistry, which will open Tuesday, May 18th, at the Armour & Thorenson Chemical Laboratories. The class will have an enrollment of 16.

A question was discussed in regards to the best floor for a plating room. About the best answer suggested was a concrete floor, to be painted with asphaltum paint, and then heat asphaltum until it flows, put on a layer of ¼ inch. Acids eat concrete in time, but do not affect the asphaltum.

Toledo.

Toledo Branch meets 1st Tuesday night each month at Toledo University Science Building, Electro-Platers' Room, corner Cherry and Page Sts. H. L. Myers, 410 Palmer St., Secretary.

Dayton.

Meets first Saturday of each month at the Y. M. C. A, Dayton, Ohio. Secretary, Alphonz Lamoureux, 432 E. Second St.

Cleveland

The Cleveland Branch meets every second and last Saturday of the month at 1344 East Prospect St. Secretary B. F. McCormick, 1941 West 77th St.

APPLICATIONS FOR MEMBERSHIP

Bridgeport

Norman Tice (associate)....42 Holmes Ave., Waterbury, Conn.

Detroit

James McPartland.....Detroit, Mich.

Chicago

Owen J. McKee.....c/o Rathbone, Sard & Co., Aurora, Ill.
Harold E. House.....320 Chippewa St., Eu Claire, Wis.

Milwaukee

John A. Maier (active).....604 Beaver St., Beaver Dam, Wis.

Philadelphia

Wm. A. Lambert.....618 Washington Ave., Scranton, Pa.

Pittsburgh

Roy L. Prunkard (active).....
.....1227 Liverpool St., N. S. Pittsburgh, Pa.
George W. Dehn (active).....
.....c/o National Casket Co., N. S. Pittsburgh, Pa.

Rochester

Joseph Ciambrone (active).....Niagara Falls, N. Y.

St. Louis

J. H. Jordan (active).....4120 Shenandoah Ave., St. Louis, Mo.
Frank Menniges (active).....3205a Arsenal St., St. Louis, Mo.

ELECTED TO MEMBERSHIP

Cincinnati

August S. Mackley (active)....108 Mulbury St., Cincinnati, O.

Indianapolis

Harry Maze (active).....312 E. North St., Indianapolis, Ind.

New York

E. C. Kornhoff (active).....62 Marsellus Pl., Garfield, N. J.

Pittsburgh

Warren Kirk Rahl (active).....Greensburg, Pa.
Joseph H. Miller (active).....Wellsburg, West Va.

Toronto

G. M. Burns (active)....74 Charlemagne St., Montreal, Quebec.